am

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/528,253	03/17/2000	Kaori Fujimura	10746/17	4420

26646 7590 05/03/2004

KENYON & KENYON
ONE BROADWAY
NEW YORK, NY 10004

EXAMINER	
AKHAVANNIK, HUSSEIN	

ART UNIT	PAPER NUMBER
2621	15

DATE MAILED: 05/03/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	**Application No.**	**Applicant(s)**	
	09/528,253	FUJIMURA ET AL.	
	Examiner	**Art Unit**	
	Hussein Akhavannik	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4,6-10,12-22,24-26,28,29,31-38 and 40-68* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *3 and 33* is/are allowed.

6)☐ Claim(s) *1,2,4,6-10,12-22,24-26,28,29,31,32,34-38 and 40-68* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *17 March 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The cancellation of claim 23 overcomes the Examiner's objection cited in paragraph 4 of the previous office action (now Paper no. 13).

Response to Arguments

2. Applicant's arguments filed February 2, 2004 have been fully considered but they are not persuasive.

The Applicant alleges that Liu et al only indicate that projection images may be used in analyzing medical images, but do not in any way disclose or suggest that the projection image can be used to correct a slice position. The Examiner respectfully disagrees.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

The Applicant alleges that combined teachings of Xu et al and Liu et al do not disclose or suggest the features of "measuring shift amount" and "correcting the slice position" recited in the context of the claimed subject matter. The Examiner respectfully disagrees. Liu et al explain in column 1, lines 14-21 that radiologists prefer to view projection images (created through Maximum Intensity Processing) rather than slice images for screening vascular morphology and pathological diseases. Determining diseases by interval changes such as a change in tumor size and a newly developed pleural effusion is the primary goal of Xu et al as explained in the abstract. Therefore, both teachings are directed toward the same goal of analyzing medical

images in order to determine malignant features, which indicate the presence of a disease. Xu et al explain measuring the shift amount between a first slice image and a second slice image in column 7, lines 27-52 and explain correcting the slice position according to the shift amount in column 8, lines 44-64. Though Xu et al measure the shift amount between two slice images rather than two projections images as claimed, it would have been obvious to one of ordinary skill in the art at the time the invention was made to instead use projection images because:

i. Liu et al explicitly explain that radiologists prefer to view projection images in rather than slice images in column 1, lines 14-21.

ii. Projection images and slice images are both 2D images and therefore, the operating principle of measuring a shift amount and correcting the slice positions as explained by Xu et al would not change by using projection images.

iii. Projection images inherently contain more information than slice images because they are determined as a function of multiple slice images ("projection of a three-dimensional (3D) volume" in column 1, lines 22-23 of Liu et al). Therefore, by using projection images, the system of Xu et al would be robust to local shifts occurring only in a slice image, thereby increasing the accuracy of the correction of slice images.

Allowable Subject Matter

3. Claims 3 and 33 are allowed.

4. The following is a statement of reasons for the indication of allowable subject matter: The prior art fails to teach or suggest the features of providing n different channels for a signal x which has 128 * n stages in context of the position correction of a projection image recited in the independent claims 3 and 33.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1, 24, 31, 55, 60, and 65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al (U.S. Patent No. 6,363,163) in view of Liu et al (U.S. Patent No. 6,023,635).

Referring to claim 1, which is representative of claims 24 and 31,

i. Inputting first tomographic images and second tomographic images is explained by Xu et al in column 4, lines 58-66. The sets of data are obtained through tomography scans and are taken at different times.

ii. Generating a first projection image from the first projection images and a second projection image from the second tomographic images is not explicitly explained by Xu et al. However, Liu et al explain in column 1, lines 14-21 that in the field of computer tomography, projection images may be created by Maximum Intensity Processing (MIP). Liu et al explain that projection images are especially useful for screening vascular morphology and pathological diseases. Detecting such diseases is also the goal of the computed tomography system of Xu et al wherein interval changes are analyzed for change in tumors size or newly developed pleural effusion as explained in the abstract. Liu et al also explain that radiologists prefer viewing projection images rather than slice images in analyzing medical images in column 1, lines 20-21. Thus, the multiple slice

images of Xu et al, which are perpendicular to the z-axis as illustrated in figures 2A and 2B, can be replaced by a projection image as suggested by Liu et al. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to generate a projection image from a series of slice image constituting a tomographic image set because:

a. Liu et al explicitly explain that radiologists prefer to view projection images in rather than slice images in column 1, lines 14-21.

b. Projection images and slice images are both 2D images and therefore, the operating principle of measuring a shift amount and correcting the slice positions as explained by Xu et al would not change by using projection images.

c. Projection images inherently contain more information than slice images because they are determined as a function of multiple slice images ("projection of a three-dimensional (3D) volume" in column 1, lines 22-23 of Liu et al). Therefore, by using projection images, the system of Xu et al would be robust to local shifts occurring only in a slice image, thereby increasing the accuracy of the correction of slice images.

iii. Measuring the shift amount between the first projection image and a second projection image by searching the second for the same area as a template generated from the first projection image is explained by Xu et al in column 7, lines 35-52 and illustrated in figure 6C for the X-axis and Y-axis correction and explained in column 6, lines 27-52 for the Z-axis direction, wherein the projection image suggested by Liu et al is substituted for the slice image. The use of a template from the first projection data is explained by

Xu et al in column 7, line 63 to column 8, line 9, the claimed template corresponding to Xu et al's "previous section image" and the claimed shift amount corresponding to Xu et al's ΔX and ΔY in column 8, lines 6-36.

iv. Correcting the slice position according to the shift amount between the first projection image and the second projection image is explained by Xu et al in column 8, lines 44-64.

v. Displaying the diagnostic image and the comparison image at a corrected slice position is explained by Xu et al is illustrated by Xu et al in figure 13 as the output device (105). Xu et al explain that this device could be a display in column 10, lines 30-32. The display is apparent as well in Xu's drawings. For example, see figures 2A-2B and 6A-6C.

Referring to claim 55, 60, and 65, the first projection image and the second projection image being used to find a comparison image whose slice position corresponds to a slice position of a diagnostic image is illustrated by Xu et al in figure 1 by the warp section image 18 and explained in column 8, lines 44-63. The comparison image corresponds to the warp image and the diagnostic image corresponds to the current section image. Xu et al explain that the warping is performed according to ΔX and ΔY determined, corresponding to claim 1iii.

7. Claims 2, 4, 6, 10, 16-19, 25-26, 28-29, 32, 34, 38, 44-47, 50-54, 56-59, 61-64, and 66-68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al in view of Liu et al, and further in view of Some et al (U.S. Patent No 5,841,148).

Referring to claims 2, 6, 25, 28, 32, and 34, all the limitations of these claims correspond to claim 1, except:

i. Aligning the resolutions of the first tomographic images and the second tomographic images by scaling one or both of the tomographic images when the resolutions of the tomographic images are different is not explained by Xu et al or Liu et al. However, Some et al do explain an image processing apparatus to enlarge or reduce images in column 13, lines 39-61. Some et al perform the magnification correction (200) before performing the template matching (202) between a first image and a second image to find a region of interest, as illustrated in figure 6. A magnification correction would be necessary to improve the probability of finding a template of a certain resolution in another image, which could be at a different resolution. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to align the resolution of the first and second tomographic images by scaling the one or both of the images when the resolutions of the two images are different so that the probability of detecting the template in a second image is increased resulting in more accurate shift measurements.

ii. Measuring the shift amount between the first projection image and a second projection image by searching the second for the same area as a template generated from the first projection image by pattern matching while shifting the template by an interval is explained by Xu et al in column 7, lines 35-52 for the X-axis and Y-axis correction and column 6, lines 27-52 for the Z-axis direction. The use of a template from the first projection data and using cross-correlation matching to find the highest correlation point

between the template and the second image group is explained by Xu et al in column 7, line 63 to column 8, line 9.

Referring to claims 4, 10, 26, 29, and 38, all of the limitations of these claims correspond to claims 2, 6, 25, 28, 32, and 34, except:

i. Generating a first projection image of the X axial direction from the first tomographic images and generating a second projection image from the second tomographic images corresponds to claim 1ii. The tomographic data supplied by Xu et al Xu et al in column 5, lines 1-7 is three-dimensional, so projection images may be generated in the X, Y, or Z axial direction using the MIP technique.

Referring to claims 16, 17, 44, and 45, generating the projection images in which a weight is assigned to the specific observation object by setting a window level and a window width is not explicitly explained by Xu et al or Liu et al. However, Some et al do explain an image data selection unit (68) that is capable of selecting a part of image data stored in memory in column 9, line 53 to column 10, line 20. This selected image data can then be processed for magnification correction and then position correction. By selecting only a portion of the projection image in memory, Some et al are assigning a weight of one to the selected window and a weight of zero to the addition portions of the image. By selecting only a portion of the projection image, computation necessary for position correction can be reduced. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select a window of the projection image by assigning weights to the original projection image because the required computation would be reduced.

Referring to claims 18, 19, 46, and 47, generating the projection images in which only a part including the distinctive part is projected is not explicitly explained by Xu et al or Liu et al. However, Some et al do illustrate projection images in which only the distinctive part is included in figure 4. By selecting only the distinctive part of the projection image, computation necessary for position correction can be reduced while the result of the template search would not suffer. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to generate a projection image in which only the distinctive part is projected because computation time and/or processing power would be reduced.

Referring to claims 50-54, finding a reference position in the Y-axial direction from the first and second tomographic image and correcting the shift in the Y axial direction on the basis of the reference position is illustrated by Xu et al in figure 6C. The reference position are illustrated in figure 4A and explained in column 7, lines 1-14 as the regions of interest, which are clearly in the Y-axial direction.

Referring to claims 56-59, 61-64, and 66-68, these claims correspond to claim 55.

8. Claims 7-8, 12, 35-36, and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al, Liu et al, and Some et al, and further in view of Moshfeghi (U.S. Patent No. 5,368,033).

Referring to claims 7 and 35, generating the projection image comprising of pixel values obtained by adding pixel values obtained by adding pixel values of the tomographic images in the X or Y axial direction or in any other direction is not explicitly explained by the systems of Xu et al or Liu et al or Some et al. Though Liu et al do explain using Maximum Intensity Processing (MIP) to determine the projection image, they do not explain summing the pixel

intensities of the multiple slice images. However, Moshfeghi does explain generating projection images of a blood vessel by summing the intensities of the voxels (three-dimensional pixels) in the viewing direction in column 9, lines 14-26 and illustrated in figure 2. The images of the blood vessel in figure 2 are obtained tomographic magnetic resonance techniques, which are analogous to the CT scanning of this application. The projection image created by Moshfeghi illustrates the thickness and overlap of the vessels that have been imaged. Such information would be obvious to use in the system of Xu et al, Liu et al, and Some et al to better define the reference positions used to align the two projection images. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to create a projection image by adding pixel values of tomographic images in any direction so that the reference positions used to determine the shift amounts are better defined.

Referring to claims 8, 12, 36, and 40, all the limitations of this claim correspond to claim 7, except:

i. Generating a projection image by interpolating the two-dimensional image is not explicitly explained by the systems of Xu et al or Liu et al or Some et al. However, Moshfeghi explains interpolating images to create projection images in column 9, lines 14-26. Moshfeghi explains that interpolating the images would be beneficial when the parallel rays do not pass precisely through the center of the voxels to resample the volumetric image to determine new voxel centers. Therefore, the interpolation would align the parallel slice image sequence to create an accurate projection image. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to generate a projection image by interpolating a two-dimensional image sequence

so that the projection images are created more accurately, resulting in a more accurate shift measurement.

9. Claims 9, 22, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al, Liu et al, and Some et, and further in view of Jang et al (U.S. Patent No. 5,862,249).

Referring to claims 9, 22, and 37, the template being an area of 25% to 50 % from the top of the first projection image in the Z axial direction is not explained by the systems of Xu et al or Liu et al or Some et al. However, Jang et al do illustrate four horizontal strip regions that are used to extract certain features from in figure 7a. Jang et al explain that the regions Rh3 and Rh4 have the same width and regions Rh1 and Rh2 have the same width in column 6, line 63 to column 7, line 4. Therefore, by setting the widths of the four regions equal to each other is would be possible to use an area 25% to 50% from the top of the first projection in the X axial direction as the template. The system of Jang et al then performs position correction similar to the system of Xu et al, Liu et al, and Some et al. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select a template to be an area 25% to 50% from the top of the first projection image in the Z axial direction to reduce the computation necessary to search for a template.

10. Claims 13-15, 20-21, 41-43, and 48-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al, Liu et al, and further in view of Kano et al (U.S. Patent No. 5,359,513).

Referring to claims 13 and 41,

i. Extracting a bed area as the reference position from the first tomographic image and second tomographic image in not explained by the systems of Xu et al or Liu et al or

Some et al. However, Kano et al do explain using the mediastinum as a region of interest to align to images in column 6, lines 12-19. Kano et al go on explain that the mediastinum is the white area near the center of the chest due to the spine and other related anatomical structures. The spine is surrounded by the backbone, so it would be included as part of the mediastinum according to the definition of Kano et al. The mediastinum is located in the bed area, as it has been imaged. Therefore, it would obvious to one of ordinary skill in the art at the time the invention was made to use the bed area as the reference position from the first tomographic image.

ii. Correcting the shift in the Y axial direction on the basis of the bed surface, the Y-axis being perpendicular to the bed surface is not explained by the systems of Xu et al or Liu et al or Some et al. However, Kano et al explain calculating the shift of an image in the Y axial direction in column 9, lines 14-26 and illustrate the calculation in figure 5. In figure 5, the Y axial direction is perpendicular to the surface of the bed when the patient is lying of his/her back. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to correct the shift in the Y axial direction on the basis of the bed surface.

Referring to claims 14 and 42, these claims correspond to claims 13 and 41. The mediastinum includes the backbone and spine, which are both body parts.

Referring to claims 15 and 43, these claims correspond to claims 13 and 41. The mediastinum includes the backbone.

Referring to claims 20, 21, 48, and 49, generating a plurality of templates and performing template matching on the second image by the plurality of templates is not explained by the

systems of Xu et al or Liu et al or Some et al. However, Kano et al do explain warping a second image on the basis of local matching of a number of small regions of interest in column 5, line 60 to column 6, line 19. Measuring the shift amount between the first projection image and the second projection image from a plurality of reference points is explained by Kano et al in column 9, lines 14-26. It would be beneficial to use multiple templates (or ROIs) to improve the accuracy of the alignment between the first and second projection image. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use multiple templates to correct the alignment between two projection images.

Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hussein Akhavannik whose telephone number is (703)306-4049. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau can be reached on (703)305-4706. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Hussein Akhavannik H.A.
April 29, 2004

BRIAN WERNER
PRIMARY EXAMINER